Form ESA-B4. Summary Report for ESA-065-3
Public Report - Final

Company	Rentech Energy Midwest	**ESA Dates**	5/5-7/2008
Plant	East Dubuque Illinois	**ESA Type**	Steam
Product	Ammonia plant	**ESA Specialist**	Jack Ciesa

Introduction: The Rentech Energy Midwest plant in East Dubuque Illinois is an anhydrous ammonia manufacturing facility. The focus of this ESA was the steam plant and its energy efficiency. The East Dubuque plant is designed to produce anhydrous ammonia, nitric acid, ammonium nitrate solution, liquid and granular urea, nitrogen solutions (urea ammonium nitrate solution or "UAN") and carbon dioxide using natural gas as a feedstock. The byproduct carbon dioxide is used in the production of urea and is compressed, liquefied, and sold for food applications such as freeze drying and carbonation. The manufacturing process takes natural gas through a reformer where the carbon and hydrogen are separated. Some carbon is discharged to the atmosphere in the form of carbon dioxide and the hydrogen is combined with nitrogen to form ammonia. The ammonia is compressed and refrigerated in large storage tanks before being shipped out of the plant in truck tankers.

Objectives of ESA: Training in the use of SSST, SSAT, and 3E+ was conducted during all 3 days of the ESA along with recognition of steam best practices, SSST scorecard results, the development of the SSAT plant base model, evaluation of steam energy efficiency measures, and reduction of plant natural gas use.

Focus of Assessment: Plant steam system optimization and evaluation of several energy cost savings measures using the DOE steam system software tool suite including SSST, SSAT, and 3E+.

Approach for ESA: A kick-off meeting was held and copies of the various DOE forms such as, the attendance sheet, intake questionnaire, summary report, evaluation sheet, and plant activity steps were distributed and discussed. The SSST scorecard spreadsheet was developed from which some energy efficiency measures were identified. A limited plant tour was made followed by more detailed review of the steam using equipment that included discussions with the plant electrical engineer and instrument engineer as well as other plant personnel. Field measurements were taken on the first day and more were taken on the second and third days. The remaining time was spent working with the plant lead establishing the SSAT base case and analyzing various energy efficiency measures. A wrap up meeting was held on the last day to discuss the ESA activities.

General Observations of Potential Opportunities:

The plant identified some energy efficiency measures on their own which are included in this report and others were added during the ESA. Overall steam plant efficiency can increase substantially mainly because there have been minimal improvements made and there has never been a way of establishing a base case model for the steam system from which energy efficiency measures can be evaluated. With the completion of the steam system study the plant now has a means of evaluating different cost reduction projects which did not exist prior to doing the ESA.

Potential Opportunities:

1. Install O2/CO trim to control excess air on the boilers.

The boilers currently do not control or record their excess air. The recommendation would be to install oxygen and CO recording and controlling on S5 and S7 to bring the overall boiler efficiency closer to best practices. Based on the current efficiency of approximately 81% raising the efficiency to 84% results in an annual savings of $227,000 which is considered to be a near term energy savings opportunity.

2. Install steam coils on combustion air to the boilers.

The boilers are taking in ambient air as their combustion air source. Boiler efficiency could be increased especially during the winter period by increasing the combustion air temperature. The plant has a source of waste low pressure steam that could be used to heat the combustion air in a steam coil. The recommendation would be to install steam heating coils on the boilers S5 and S7 increasing the combustion air temperature approximately 100ºF resulting in an annual savings of $109,000 which is considered to be a medium term energy savings opportunity.

3. Install electric motor drive on C1 turbine.

The C1 condensing steam turbine drives the main refomer air compressor. The recommendation is to replace the condensing turbine with an electric motor resulting in an annual savings of $1,531,000 which based on the estimated cost is considered to be a medium term energy savings opportunity.

4. Install new high efficiency rotor on C4 turbine.

The condensing steam turbine on the C4 ammonia refrigeration compressor was installed as original equipment in 1965 when the plant was built. The recommendation is to replace the steam turbine rotor with a more efficient rotor thus lowering the steam requirement for ammonia refrigeration. This results in an annual savings of $136,600 which is considered to be a long term energy savings opportunity.

5. Increase condensate return.

Most of the steam that is generating is direct inject into the process so therefore is not recoverable. There is still a reasonable amount of steam condensate that is not direct inject, approximately 35% that could be recovered. The proposal would be to get the plant condensate return up closer to best practices which is the basis of this EEM. This results in an annual savings of $85,000 which is considered to be a long term energy savings opportunity.

6. Reduce boiler blowdown.

Then plant uses well water for the water supply and for steam generation. The boilers run at approximately 6 cycles of concentration using cold lime and zeolite softening. By installing reverse osmosis the cycles of concentration can be increased to approximately 50 cycles of concentration thus reducing the energy losses due to blowdown. It's recommended to consider an R/O system as an addition to the current softening system which will save $154,000 a year which is considered to be a near term energy savings project.

7. Repair steam leaks.

Generally there was not a huge number of steam leaks observed during the ESA but this is an area can still be improved. Especially with the cost of gas repairing steam leaks pay themselves very quickly. Since the plant is very large it's impossible to get a real handle on the total number of leaks within the time of the ESA so SSAT was used to estimate a savings by assuming that leaks can be reduced by ½ resulting in an annual savings of $18,000 which is considered to be a near term energy savings project.

8. Repair steam traps.

The plant has on the order of 1,000 steam traps at the high, medium, and low steam pressure levels. The plant had a steam trap survey done at the same time of the ESA and it has been estimated that out of the total plant traps 373 can be considered to be on the gas boiler system. It was found that out of 373 traps that are considered part of the steam plant system 237 were failed. By repairing approximately half of the failed traps there's an annual savings of $396,000 which is considered to be a near term energy reduction project.

9. Tune boiler S7.

The steam plant boilers were tested for efficiency on 2 separate occasions. Boiler S5 was found to be operating in an efficient range while boiler S7 had somewhat of a high excess air level at the load it was running during the test. Since S7 is the primary boiler and found to be operating at a high excess air it's recommended that S7 be tuned for higher efficiency. It was assumed that the efficiency of S7 could be at least as high as S5 resulting in an annual savings of $209,000 which is considered to be a near term energy savings project.

Management Support and Comments:
1. The kick-off meeting brought out some items that the plant needs to consider by comparing the current operation to best practices using the SSST spreadsheet.
2. Plant will use the SSAT tool to justify expenditures.
3. The ESA increased steam system understanding.
4. Expert was easy to work with and explained issues very well.
5. Doing the plant steam audit in 3 days was difficult; more time would have been a benefit.
6. A tremendous variety of data was collected to fine tune the SSAT base model during the ESA.
7. ESA generated a good list of energy savings projects.

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